I claim:

1. An air cooling ring for supplying successive streams of cooling air to a surface of a tubular bubble of plastic, after its extrusion from an annular die surface, said annular die surface having a die axis, said air cooling ring comprising:

a ring-shaped plenum chamber which is provided radially-outwardly of said die axis from said annular die orifice, said ring-shaped plenum chamber having an air inlet and an air outlet, said ring-shaped plenum chamber including an upper lip which encompasses said air inlet, and a lower deflector lip;

a forming cone extending radially-outwardly from said air cooling ring, said forming cone including an air passage which communicates with said air outlet of said ring-shaped plenum chamber;

a plurality of axial outlet ports communicating with said air passage;

an annular air chamber communicating with said plurality of axial outlet ports; and

a lower annular air outlet at the base of said forming cone;

whereby:

cooling air is directed downwardly and radially-outwardly to be discharged out of said lower annular air outlet, and then to be diverted into two paths, a first path being in an upward direction between an outer conical surface of said forming cone and an outer surface of said tubular bubble of plastic, a second path being in a direction radially-and-horizontally-inwardly between said upper lip of said lower portion of said air cooling ring and said deflector lip.

2. An air cooling ring for supplying successive streams of cooling air to a surface of a tubular bubble of plastic, after its extrusion from an annular die surface, said annular die surface having a die axis, said air cooling ring comprising:

a ring-shaped plenum chamber which is provided radially-outwardly of said die axis from said annular die orifice, said ring-shaped plenum chamber having an air inlet and upper and lower air outlet, said ring-shaped plenum chamber including an upper lip which encompasses said air inlet, and a lower deflector lip;

a forming cone extending radially-outwardly from said air cooling ring, said forming cone including an air passage which communicates with said lower air outlet of

said ring-shaped plenum chamber, and providing a divider between said upper and lower air outlet;

a plurality of axial outlet ports communicating with said air passage;

an annular air chamber communicating with said plurality of axial outlet ports; and

a lower annular air outlet at the base of said forming cone;

whereby:

cooling air from said lower air outlet is directed downwardly and radially-outwardly to be discharged out of said lower annular air outlet, and then to be diverted into two paths, a first path being in an upward direction between an outer conical surface of said forming cone and an outer surface of said tubular bubble of plastic, a second path being in a direction radially-and horizontally-inwardly between said upper lip of the lower portion of said air cooling ring and said deflector lip; and

cooling air from said upper air outlet means is directed upwardly in contact with an inner upper conical surface of said forming cone and then to contact an outer surface of said tubular bubble of plastic.

3. The air cooling ring means of claim 1, wherein said upper lip is configured to be vertically movable, both upwardly and downwardly.

4. The air cooling ring means of claim 2, wherein said upper lip is configured to be vertically movable, both upwardly and downwardly.

5. The air cooling of claim 1, wherein said forming cone includes a lower inner surface comprising a first inner disc merging into a first downward and outward conical surface, which merges into a second downward and outward conical surface terminating at said lower annular air outlet.

6. The air cooling ring of claim 5 including a second inner disc is vertically spaced-apart from said first inner disc, to define said lower air outlet means therebetween.

7. The air cooling ring of claim 6, wherein said second inner disc merges into a first upper inner conical surface which merges into a second upper conical surface which terminates at an upper annular air outlet.

8. The air cooling ring of claim 3, wherein said upper lip is vertically-movable by electrically operated means.

9. The air cooling ring of claim 4, wherein said upper lip is vertically-movable by electrically operated means.

10. The air cooling ring of claim 3, wherein said upper lip is vertically-movable by hydraulically-operated means.

11. The air cooling ring of claim 4, wherein said upper lip is vertically-movable by hydraulically-operated means.

12. The air cooling ring of claim 3, wherein said upper lip is vertically-movable by pneumatically-operated means.

13. The air cooling ring of claim 4, wherein said upper lip is vertically-movable by pneumatically-operated means.

14. The air cooling ring of claim 3, wherein said upper lip is vertically-movable by manually-operated means.

15. The air cooling ring of claim 4, wherein said upper lip is vertically-movable by manually-operated means.

16. Apparatus for extruding a tubular plastic bubble comprising:
a plastic extruder having an annular die orifice and having a cooling air inlet; and
an air cooling ring, said air cooling ring comprising:

a ring-shaped plenum chamber which is provided radially-outwardly of said die axis from said annular die orifice, said ring-shaped plenum chamber having an air inlet and an air outlet, said ring-shaped plenum chamber including an upper lip which encompasses said air inlet, and a lower deflector lip;

a forming cone extending radially-outwardly from said air cooling ring, said forming cone including an air passage which communicates with said air outlet of said ring-shaped plenum chamber;

a plurality of axial outlet ports communicating with said air passage;

an annular air chamber communicating with said plurality of axial outlet ports; and

a lower annular air outlet at the base of said forming cone;

whereby:

cooling air is directed downwardly and radially-outwardly to be discharged out of said lower annular air outlet, and then to be diverted into two paths, a first path being in an upward direction between a conical surface of said forming cone and an outer surface of said tubular bubble of plastic, a second path being in a direction radially-and-horizontally-inwardly between said upper lip of the lower portion of said air cooling ring and said deflector lip.

17. Apparatus for extruding a tubular plastic bubble comprising:

a plastic extruder having an annular orifice surrounding a die axis and having a cooling air inlet; and

an air cooling ring, said air cooling ring comprising:

a ring-shaped plenum chamber which is provided radially-outwardly of said die axis from said annular die orifice, said ring-shaped plenum chamber having an air inlet and upper and lower air outlets, said ring-shaped plenum chamber including an upper lip which encompasses said air inlet, and a lower deflector lip;

a forming cone extending radially-outwardly from said air cooling ring, said forming cone including an air passage which communicates with said lower air outlet of said ring-shaped plenum chamber, and providing a divider between said upper and lower air outlets;

a plurality of axial outlet ports communicating with said air passage;

an annular air chamber communicating with said plurality of axial outlet ports; and

a lower annular air outlet at the base of said forming cone;

whereby:

cooling air from said lower air outlet is directed downwardly and radially-outwardly to be discharged out of said lower annular air outlet, and then to be diverted into two paths, a first path being in an upward direction between a conical surface of said forming cone and an outer surface of said tubular bubble of plastic, a second path being in a direction radially-and horizontally-inwardly between said upper lip of the lower portion of said air cooling ring and said deflector lip; and

cooling air from said upper air outlet is directed upwardly in contact with an inner upper conical surface of said forming cone and then to contact an outer surface of said tubular bubble of plastic.

18. The apparatus of claim 16, wherein said upper lip is configured to be vertically movable, both upwardly and downwardly.

19. The apparatus of claim 17, wherein said upper lip is configured to be vertically movable, both upwardly and downwardly.

20. The apparatus of claim 16, wherein said forming cone includes a lower inner surface comprising a first inner disc merging into a first downward and outward conical surface which merges into a second downward and outward conical surface terminating at said lower annular air outlet.

21. The apparatus of claim 20, wherein said air cooling ring of claim 4 including a second inner disc vertically spaced-apart from said first inner disc, to define said lower air outlet means therebetween.

22. The apparatus of claim 21, wherein said second inner disc merges into a first upper inner conical surface which merges into a second upper conical surface which terminates at an upper annular air outlet.

23. A method for supplying successive streams of cooling air to an inner surface of a tubular bubble of plastic, after its extrusion from an annular die surface, said annular die surface having a die axis, said method comprising:

providing a ring-shaped plenum chamber radially-outwardly of said die axis from said annular die orifice;

providing an air inlet into said ring-shaped plenum chamber;

providing said ring-shaped plenum chamber with an upper lip which is formed with said air inlet, and with a lower deflector lip;

providing a forming cone radially-outwardly of said air ring-shaped plenum chamber;

providing an annular air passage within said forming cone;

providing a plurality of radial outlet ports in said annular air passage to communicate with said air inlet in said ring-shaped plenum chamber;

providing an annular air outlet communicating with said axial outlet ports;

directing cooling air, by means of said annular air outlet, downwardly and radially-outwardly to a lower annular air outlet; and

then diverting said cooling air both in an upward direction between a conical inner surface of said forming cone and an outer surface of said tubular bubble of plastic, and radially-inwardly between said upper lip of said ring and said deflector lip.

24. A method for supplying successive streams of cooling air to a surface of a tubular bubble of plastic, after its extrusion from an annular die surface, said annular die surface having a die axis, said air method comprising:

providing a ring-shaped plenum chamber radially-outwardly of said die axis from said annular die orifice;

providing an air inlet into said ring-shaped plenum chamber;

providing said ring-shaped plenum chamber with an upper lip which is formed with said air inlet, and with a lower deflector lip;

providing a forming cone radially-outwardly of said air ring-shaped plenum chamber;

providing an annular air passage within said forming cone;

providing a plurality of radial outlet ports in said annular air passage to communicate with said air inlet in said ring-shaped plenum chamber;

providing a first annular air communication with said axial outlet ports;

providing a second annular inner outlet means communicating with said air outlet;

directing cooling air, by means of said first annular air inlet downwardly and radially-outwardly to a lower annular air outlet and then diverting said cooling air both in an upward direction between a conical outer surface of said forming cone and an inner surface of said tubular bubble of plastic, and radially-inwardly between said upper lip of said ring and said deflector lip; and

directing a second stream of cooling air by means of said second annular air outlet means radially-outwardly of said upper lip towards the path of said tubular bubble, in contact with a conical surface of said forming cone and an outer surface of said tubular bubble.